

## R3 New Start Project:

*The GLM Ground Flash Fraction Retrieval Algorithm: Improvement, Testing, and Demonstration*



## Investigators:

*William Koshak (NASA-MSFC), Richard Solakiewicz (Chicago State University)*

## Function of the Algorithm:

*Analyze optical properties of  $N$  GLM-observed lightning flashes to estimate fraction of ground flashes.*

## Application of the Algorithm:

*Ground flash fraction important for assessing: Severe Wx, LNOx Production, Global Electric Circuit.*

# Summary of Plans (Objectives & Techniques):

## 1. Obtain the Grobner-Initialization

- a) Extend moment method to include not just mean & variance of a lightning optical characteristic, but also skewness.
- b) Obtain a set of 3 polynomial equations in 3 unknowns (alpha, mhug, mhuc).
- c) To solve the set, find the Grobner bases (*Mathematica's efficient version of Buchberger algorithm*).
- d) Pick the 3 simplest bases, and solve for (alpha, mhug, mhuc).
- e) Back-substitute into original set to verify unique solution.



# Summary of Plans (cont.):

## 2. Implement Grobner Initialization

- a) Remove existing estimative initialization scheme from the Ground Flash Fraction Algorithm (GoFFRA).
- b) Insert the Grobner initialization scheme into GoFFRA.

## 3. Test Grobner Initialization

- a) Run Grobner-modified GoFFRA on previous MGA datasets derived from OTD.
- b) Compare results with earlier GoFFRA runs to assess impact of Grobner initialization.
- c) Run Grobner-modified GoFFRA on OTD data over the US & compare with NLDN to assess accuracy of ground flash fraction retrieval. High flash rate storms along cold fronts will be a priority.
- d) Upgrade GoFFRA code as appropriate.

**... The above 3 items are for Year 1. Years 2 & 3 will extend tests to LIS data, with again an emphasis on picking sets of high flash rate storms along cold fronts in order to better assess benefits of GoFFRA to Severe Wx analyses/warnings.**



# See Poster

- R3 new start funds arrived @ MSFC on Sept 6, 2011.
- But, preliminary results have already been obtained. For details, see poster: *“Obtaining the Grobner Initialization for the Ground Flash Fraction Retrieval Algorithm”*.